COMMONWEALTH OIL REFINING COMPANY, INC.

U. O. P. INC.
CIC INSPECTION REPORT
OCTOBER 17, 1990

EXECUTIVE SUMMARY

A initial inspection of the Isoprene Extraction Unit was started on September 21, 1990 after a pre-inspection meeting on September 20 at CORCO in Penuelas, Puerto, Rico. The meeting covered a general discussion of the inspection work to be performed by UOP for CORCO. The unit has been out of service and in mothball for approximately 12 years. In attendance at this meeting were CORCO V.P. of Administration Mr. Pedro Santiago and Engineer Mr. Carlos Oquendo; Nippon Zeon Company, LTD. General Manager Licensing Department Mr. Hachiro Ohsata and Senior Process Engineer Process Department Mr.T. Oguchi; UOP Assistant Director of Maintenance and Inspection Mr. Mike Mikulicz and UOP Inspectors Mr. Denver Alton and Mr. William A. Diggins, III.

Mr. Alton and Mr. Diggins inspected process equipment in the Isoprene Unit until October 17, 1990. The inspection was temporary halted at that time. This discission was base on the inspection findings to date and the need to expand the scope of inspection because of the external corrosion problems found. The scope of preparation and inspection must be expanded to determine the extent of external corrosion that has occurred since the unit was mothball to the pressure retaining parts (i.e heads, shells, nozzles, and/or stiffening rings) of insulated towers, drums, tubular heat exchangers, process and utility lines and insulated over nonpressure parts (i.e. support attachments, ladder and platform lugs) for repairs or replacements. Random inspections of process equipment where insulation has been removed has found slight to severe external corrosion and a more through inspection is required by UOP to define the present condition of the equipment contained in this unit for repair or replacement recommendations.

The following is a summary of the inspection findings to date. A formalized inspection report will be issued upon the completion of the inspection of this unit. The summary is divided into 5 parts (1) towers, (2) drums, (3) tubular heat exchangers, (4) process and utility piping, and (5) the boiler. It should be noted that only the item number of process equipment is given since the service of the equipment is not known.

TOWERS

GENERAL

A random spot examination of some towers has found severe external corrosion to stiffener and insulation support rings and to the shell just above the rings. The affected area above rings measures from 2 to 8 inches. It is for this reason we recommend that all towers be scaffold and the insulation removed to inspect for external corrosion.

INSPECTION: ONE (1) WEEK

ACTION: CORCO: REMOVE INSULATION IN ALL TOWERS

Repair or replace ladders, handrails and platforms on all towers as required. Severe corrosion found to these items. Some of this equipment is at or near failure. Extreme cautions should be exercised by personnel climbing towers in this unit. Signs should be posted and areas roped off.

ACTION CORCO LADDERS PLATFORM

IV-110

This tower was scaffold and the insulation on the east and west side of the top five stiffener rings was removed to check for external corrosion. Where checked severe metal loss was found to the rings and to shell 3 to 6 inches above the rings. Metal loses from .25 to .32". Remaining wall thickness above top ring is approximately .04". Second ring down remaining wall is .12" in some areas. Third ring down remaining wall is .05 in some areas. Fourth ring down remaining wall is .13" in some areas. Fifth ring down remaining wall thickness is .17" in some areas. Corrosion allowance for this tower is .125". Required thickness is not known. Extent of external corrosion to this tower is not known until tower's insulation can be completely stripped.

IV-120

Water seeping in behind insulation of top head. External corrosion to 18" Vapor Outlet nozzle up to .125". Severe external corrosion up to 2" drain nozzle in bottom head, metal loss .17". Repair 18" and replace 2" from flange back to elbow. Insulation not removed to check for external corrosion to shell and stiffening rings. Recommend a complete external inspection after insulation is removed.

Clean trays. Valve caps found frozen in upper section of tower. One to two valve caps out of position through out tower, replace when closing. Pitting corrosion found from tray 142 down to bottom head. Metal loss approximately .07". Check Nippon to see what type material could be used to strip line this area. Renew bottom chimney tray which is severely pitted.

ACTION NIPPON

IV-130

Severe external corrosion to 1 1/2" PI and TI nozzles, renew. External corrosion found to shell just above support ring that is above bottom manway. Metal loss up to .09". Corrosion allowance for this tower is .125". Minimum thickness at this point is .56". Required shell thickness is not known.

The sieve trays and other internal equipment was found in serviceable condition.

IV-210A

This tower has not yet been examined for external corrosion. It is recommended that this be done, strip insulation from tower. Recommend 2" drain nozzle be renewed from flange back to elbow, metal loss from external corrosion is .08".

One to a half dozen valve caps are missing from trays through out this tower. Replace when closing tray manways.

IV-210B

Renew 2" outlet nozzle in the bottom of this tower from flange back to elbow. Metal loss from external corrosion is .14". This tower has not yet been examined for external corrosion. It is recommended that this be done, strip insulation from tower.

Trays in lower section of tower were found blown out of position. This area of the tower could not be inspected at this time. Reposition trays and inspect this area for internal corrosion.

IV-220

This tower was spot checked for external corrosion. External corrosion was found to a number of nozzles on this tower. The bottom manway and the 1 1/2" drain nozzle are severely corroded and need repair. External corrosion up to .21" found to shell just below top head. Remaining wall thickness of shell in this area is .13". External corrosion with metal loss up to .22" found to shell just below middle manway. Remaining wall thickness is approximately .28". Corrosion allowance is .125". Required thickness is not known. External corrosion can also be seen to the shell at the bottom of the tower where the insulation does not overlap the fireproofed skirt. Metal loss up .05" measured. Top 4" feed line found corroded to failure due to external corrosion.

IV-310A

This tower was spot checked for external corrosion. Severe external corrosion was found where insulation was removed. The shell just below the top head has external metal loss up to .25". Remaining wall thickness in the area checked is .13". Vessel has a corrosion allowance of .125". Required thickness is not known. Two other areas checked have metal loss of .13". At least 6 nozzles will require repairs because of external corrosion. Top 20 valve tray are in serviceable condition, but the rest of the trays have been cut by spinning valve caps and numerous valve caps are out of position. Place valve caps back into position for a one to two year run then renew trays.

IV-310B

The two level control nozzles, the two level gage nozzles, and the 2" drain line in the bottom head will require repairs because of external corrosion. The valve trays in this tower are in the same condition as IV-310A. Place valves back into their position for a one to two year run then renew trays.

IV-320

Sieve trays are dirty and require cleaning. The two level control nozzles, the two level gage nozzles, the bottom manway nozzle, the 2" drain, the 6" bottoms and the two 8" reboiler nozzles will require repairs because of external corrosion.

IV-330

The 1 1/2" reboiler outlet nozzle will require repair because of external corrosion as will the bottom manway and the lower 1 1/2" TI nozzle. Tighten loose bolting of the top internal grate.

IV-340

Bottom head of this tower is corroded and thin. Thickness measurements range from .39" to .55". Required thickness not known. Corrosion allowance .125. Head will need replacement or repairs. Replace the reboiler vapor return baffle which is corroded to failure. The trays in this tower are dirty and need cleaning. The top 1 1/2" level gage nozzle, 2" drain nozzle and 8" bottoms nozzles require repairs because of external corrosion. Tighten loose bolting to support of top reflux distributor pipe.

IV-410

Renew 2" drain nozzle in the bottom of this tower from flange back to elbow. Metal loss from external corrosion is .09". Minor repairs are required to put downcomers plates which have bowed out of clips and to replace missing and loose tray support clips and bolting on the sieve trays. Note: This tower has stiffening rings.

IV-510

The following nozzles will require repairs because of external corrosion: the two level control nozzles, the two level gage nozzles, the 2" inlet, the 1 1/2" TI, the bottom manway, the 2" reboiler, the 1 1/2" drain, the 4" bottoms and the two 8" reboiler vapor returns. The trays are in serviceable condition.

IV-520

Water seeping into breaks in top head insulation. This tower was spot checked for external corrosion. Slight to severe external corrosion was found where insulation was removed. Metal lost up to .11" was found to the shell near the second manway from the top of tower. Remaining wall thickness in the area checked is .40". Vessel has a corrosion allowance of .125". Required thickness is not known. A 1 1/2" nozzle at the top of the tower, the third manway from the top of the tower and the 20" reboiler vapor return will require repair because of external corrosion.

IV-530

This tower was spot checked for external corrosion. Slight to severe external corrosion was found where insulation was removed. Metal lost up to .10" was found to the shell just below the top head. Remaining wall thickness in the area checked is .40". Vessel has a corrosion allowance of .125". Required thickness is not known. A number of nozzles will require repair because of external corrosion.

IV-610

The following nozzles will require repairs because of external corrosion: the two level control nozzles, the two level gage nozzles, the 1 1/2" inlet, the 1 1/2" PI and TI, the 2" drain. The trays and bottom of downcomers are very dirty and need cleaning. Tray valves frozen shut. A few valve caps are out in each tray. Replace when closing manways. The LC and LG nozzles are plugged off with scale debris.

IV-620

Top head insulation found in poor condition. External corrosion to top head is approximately .05". Remaining wall thickness is .29". External corrosion was found to the following nozzles: the bottom manway, the 1 1/2" TI and PI, and the 1 1/2" bottoms outlet and drain. These nozzles will all require repairs.

DRUMS

GENERAL

Stairs, hand rails, and platforms are in poor to good condition because of corrosion. Some platform decks have small areas corroded through. Caution must be exercised by personnel using this equipment. Dangerous areas should be marked or roped off. Repair or replace as required.

IV-111

Other than renewing all gaskets this drum is in serviceable condition.

IV-112 REACTOR

Internal and ultrasonic thickness measurements found no apparent corrosion problems, but the vessel is insulated. Recommend insulation be removed to check for external corrosion.

IV-121

Internal inspection found original fabrication discontinuities such as weld underfill and undercut. It is recommended that these discontinuities be corrected. Steel plugs were found in the weep holes of several nozzle reinforcement pads. This is a code violation, remove these plugs. It is also recommended that all gaskets for this drum be replaced. Paint on this uninsulated drum is failing. It should be repaired to check external corrosion which is active.

IV-131

Other than renewing all gaskets this drum is in serviceable condition.

IV-132

Repair paint to check external corrosion. Clean scale debris from inside drum and replace all gaskets.

IV-151

No apparent corrosion or metal loss problems were found to this insulated drum, but recommend that the insulation be removed to check for external corrosion.

IV-153

This drum was not opened. Recommend it be opened and the insulation be removed for inspection.

IV-161

The nozzles on the ID of this drum are not back welded as required by code. Access to inside is limited because there is no manway. These nozzles should be repaired.

IV-162

Steel plugs found in weep holes of nozzle reinforcement pads. Remove all plugs and air test pads at 15 PSIG. No apparent corrosion or metal loss noted to this uninsulated drum.

IV-163

Internal inspection is limited to looking thorough handholes. No appreciable corrosion or metal lost problems were found. Several nozzle reinforcement pads do not have the required code weep hole in them. Recommend weep holes be added to all pads that do not have them and the pads air tested at 15 PSIG and the welds checked with soapy water.

IV-164

No apparent problems were noted to this drum which only has handholes for internal inspection. Recommend insulation be removed for external inspection of drum.

IV-165

Other than renewing all gaskets this drum was found in serviceable condition.

IV-166

This drum was not inspected.

IV-171

This drum was not inspected.

IV-211

Clean out bottom third of vessel and water boot. Repair paint to check external corrosion. Metal loss approximately .05".

IV-213

Insulation in poor condition. External corrosion seen on nozzles and shell. Strip insulation for close inspection.

IV-214

Same as IV-213.

IV-221

Head to small shell ring weld has lack of penetration and undercut from 3 to 9 o'clock. Back gouge weld to good metal, penetrant test, and back weld. Repair paint to check external corrosion. Metal lost up to .08".

IV-222

Internal and ultrasonic thickness measurements found no apparent corrosion problems, but the vessel is insulated. Recommend insulation be removed to check for external corrosion.

IV-223

This vessel is partially insulated. Recommend insulation be removed for inspection of drum for external corrosion. Paint needs repairs where vessel is not insulated to check external corrosion.

IV-311

Other than renewing all gaskets this vessel is in serviceable condition.

IV-321

Repair paint to check external corrosion. Metal loss approximately .03".

IV-323

Nozzles not back welded as required by code. Access is limited because there is no manway. Nozzles should be back welded.

IV-331

This drum is in serviceable condition. Renew all gaskets.

IV-341

Other than renewing all gaskets this vessel is in serviceable condition.

IV-342

Access limited to inspection from handholes. Nozzles on ID not back welded as required by code. Recommend all nozzles be back welded. No weep holes in reinforcement pad of hand hole nozzles. Add weep holes required by code and air test pad at 15 PSIG.

IV-343

Head to shell weld seam on east end of drum and nozzles welds are not back welded. Back gouge these welds to good metal, pentrant test, and back weld.

IV-344

This drum was not inspected.

IV-362

Access limited to inspection from handholes. Nozzles on ID not back welded as required by code. Recommend all nozzles be back welded. Renew all gaskets for this drum.

IV-371

This drum was not inspected.

IV-411

Repair paint to check external corrosion. Metal loss up to .05". Renew all gaskets for this drum.

IV-413

Repair paint to check external corrosion. Renew all gaskets on this drum.

IV-421

Nozzles of this drum are not back welded on the inside of the drum as required by code. Back gouge all nozzle welds to good metal, pentrant test, and back weld.

IV-511

Drum is in serviceable conditjon. Renew all gaskets.

IV-512A

External corrosion found to the nozzles of this drum. Repair the 2", 1 1/2" vent, 2" inlet, 1 1/2" and 2" drain, and the 2" bottom outlet nozzles which have suffered severe metal loss. Remove insulation to check for external corrosion to shell and heads.

IV-512B

External corrosion found to the nozzles of this drum. Repair the 1 1/2" outlet, the two 1 1/2" vents, the 2" inlet, the 3" outlet, the 1 1/2" and 2" drains nozzles. All have suffered severe metal loss. Remove insulation to check for external corrosion to shell and heads.

IV-521

Repair paint to check external corrosion. Metal lost approximately .02". Renew all gaskets.

IV-531

No weep holes in reinforcement pad of hand hole nozzles. Add weep holes required by code and air test pad at 15 PSIG. Renew all gaskets.

IV-542

This drum was not opened. Recommend it be opened and the insulation be removed for inspection.

IV-611

Repair paint to check external corrosion. Metal lost up to .05". Renew gaskets.

IV-612

Insulation on bottom head failed. Remove all insulation from this drum to check for external corrosion. No apparent corrosion or metal loss on ID of drum.

IV-613

Nozzle coupling in this drum are not back welded on the inside as required by code. Back gouge all coupling welds to good metal, pentrant test, and back weld.

IV-614

Numerous areas of localized external corrosion with metal loss up to .15". Recommend weld repairs to build up wasted areas, also painting vessel to check corrosion after repairs. Renew all gaskets.

IV-621

Repaint drum to check external corrosion. Metal loss up to .04"

IV-641

Not inspected.

IV-643

Vessel not opened. Open for inspection.

IV-913

This uninsulated vessel was found in serviceable condition. Renew all gaskets.

IV-941

Not inspected.

IV-931

This uninsulated vessel was found in serviceable condition. Renew all gaskets. Should seal the bottom skirt flange to prevent water from entering.

TUBULAR HEAT EXCHANGERS

GENERAL

Most of the tubular exchangers in this unit are the fixed tubesheet type. Only some of the heat exchangers and some reboilers have tube bundles that be can removed. The bundles that have not been removed should be removed for cleaning and inspection. No bundles have been cleaned to date. It is recommended that all bundle be cleaned except for those contained in this summary that we are

IV-223

This vessel is partially insulated. Recommend insulation be removed for inspection of drum for external corrosion. Paint needs repairs where vessel is not insulated to check external corrosion.

IV-311

Other than renewing all gaskets this vessel is in serviceable condition.

IV-321

Repair paint to check external corrosion. Metal loss approximately .03".

IV-323

Nozzles not back welded as required by code. Access is limited because there is no manway. Nozzles should be back welded.

IV-331

This drum is in serviceable condition. Renew all gaskets.

IV-341

Other than renewing all gaskets this vessel is in serviceable condition.

IV-342

Access limited to inspection from handholes. Nozzles on ID not back welded as required by code. Recommend all nozzles be back welded. No weep holes in reinforcement pad of hand hole nozzles. Add weep holes required by code and air test pad at 15 PSIG.

IV-343

Head to shell weld seam on east end of drum and nozzles welds are not back welded. Back gouge these welds to good metal, pentrant test, and back weld.

IV-344

This drum was not inspected.

IV-362

Access limited to inspection from handholes. Nozzles on ID not back welded as required by code. Recommend all nozzles be back welded. Renew all gaskets for this drum.

IV-371

This drum was not inspected.

IV-411

Repair paint to check external corrosion. Metal loss up to .05". Renew all gaskets for this drum.

IV-413

Repair paint to check external corrosion. Renew all gaskets on this drum.

IV-421

Nozzles of this drum are not back welded on the inside of the drum as required by code. Back gouge all nozzle welds to good metal, pentrant test, and back weld.

IV-511

Drum is in serviceable conditjon. Renew all gaskets.

IV-512A

External corrosion found to the nozzles of this drum. Repair the 2", 1 1/2" vent, 2" inlet, 1 1/2" and 2" drain, and the 2" bottom outlet nozzles which have suffered severe metal loss. Remove insulation to check for external corrosion to shell and heads.

IV-512B

External corrosion found to the nozzles of this drum. Repair the 1 1/2" outlet, the two 1 1/2" vents, the 2" inlet, the 3" outlet, the 1 1/2" and 2" drains nozzles. All have suffered severe metal loss. Remove insulation to check for external corrosion to shell and heads.

IV-521

Repair paint to check external corrosion. Metal lost approximately .02". Renew all gaskets.

IV-531

No weep holes in reinforcement pad of hand hole nozzles. Add weep holes required by code and air test pad at 15 PSIG. Renew all gaskets.

IV-542

This drum was not opened. Recommend it be opened and the insulation be removed for inspection.

IV-611

Repair paint to check external corrosion. Metal lost up to .05". Renew gaskets.

IV-612

Insulation on bottom head failed. Remove all insulation from this drum to check for external corrosion. No apparent corrosion or metal loss on ID of drum.

IV-613

Nozzle coupling in this drum are not back welded on the inside as required by code. Back gouge all coupling welds to good metal, pentrant test, and back weld.

IV-614

Numerous areas of localized external corrosion with metal loss up to .15". Recommend weld repairs to build up wasted areas, also painting vessel to check corrosion after repairs. Renew all gaskets.

IV-621

Repaint drum to check external corrosion. Metal loss up to .04"

IV-641

Not inspected.

IV-643

Vessel not opened. Open for inspection.

IV-913

This uninsulated vessel was found in serviceable condition. Renew all gaskets.

IV-941

Not inspected.

IV-931

This uninsulated vessel was found in serviceable condition. Renew all gaskets. Should seal the bottom skirt flange to prevent water from entering.

TUBULAR HEAT EXCHANGERS

GENERAL

Most of the tubular exchangers in this unit are the fixed tubesheet type. Only some of the heat exchangers and some reboilers have tube bundles that be can removed. The bundles that have not been removed should be removed for cleaning and inspection. No bundles have been cleaned to date. It is recommended that all bundle be cleaned except for those contained in this summary that we are

recommending be renewed.

It was noted most of the overhead condenser bundle which are fixed tubesheets have carbon steel tubes. A good visual inspection could not be made of these bundles for tubeside water corrosion until they are cleaned. It also suggested that all bundles be hydrotested after cleaning and if possible spot examined for corrosion thinning by the remote field eddy current testing method after cleaning. Those bundles which all ready have tubes plugged off should be replaced.

Strip all insulated exchanger equipment to check for external corrosion.

Renew all gaskets and corroded bolting.

IE-111

Tube ends corroded and thin. Renew bundle.

IE-121

Tube ends corroded and thin. Renew bundle.

IE-131

Bundle needs tubeside cleaned to check ID corrosion.

IE-161

Renew 1 1/2" vent nozzle of cover plate for outlet box. Renew all bolting.

IE-163

Tube ends corroded back to tubesheet reinspect after cleaning.

IE-164

Remove insulation to check for external corrosion. Renew or repair 2" channel inlet and outlet nozzle and replace drain coupling in bottom of outlet box. All have severe metal lost from external corrosion.

IE-313A

Pull and clean bundle. Top pass of tubes are thin. Renew top pass if rest bundle passes after it is cleaned.

IE-314

Remove floating head from bundle for cleaning and inspection.

IE-323

Renew this exchanger.

IE-342A

Outlet nozzle in outlet box corroded on ID to .10" to .12". Repair or replace. Check Nippon to see what material can be used to strip line nozzle. Tube ID's corroded and thin. Renew bundle. Check Nippon to see if a different material can be used for tubes.

IE-342B

Same as IE-342A except 6 tubes plugged off. Outlet box may also require weld repair and strip lining.

IE-361

Renew 2" vent nozzle on coyer plate of outlet box because of severe OD corrosion. Renew all bolting and gaskets.

IE-413

Two tubes plugged, one on recent hydrotest. Recommend bundle be renewed.

IE-421

Three tubes plugged on recent hydrotest. Recommend bundle be renewed.

IE-521

One tube previously plugged. Recommend bundle be renewed.

IE-522

Attach nameplate which is loose.

IE-531

Five tube plugged, three on recent hydrotest. Recommend bundle be renewed.

IE-532

Flange to head weld seam of inlet bonnet has a 3/4" crack and lack of penetration. Remove both to good metal and weld repair.

IE-612

Thirty-three tubes are plugged off in this bundle. Renew bundle.

IE-613B

Bundle not pulled. Severe external corrosion on bottom 4" shell nozzle and its 1 1/2" instrument connection. Repair 4" and replace 1 1/2".

IE-614

Six tubes plugged, 4 on recent hydrotest. Renew bundle.

IE-622

Carbon steel baffles corroded and thin. Hydrotest bundle and renew it after first run if it passes hydro.

IE-313A

Strip insulation and pull bundle. External corrosion noted on all nozzles. Repair or replace channel nozzles. Renew or repair the top shell 1 1/2" nozzle and the bottom shell 6" nozzle. Both have suffered severe metal loss from external corrosion.

Closely inspect all nozzles for external corrosion. The 1 1/2" nozzle on the bottom of the shell is bent, MT weld for cracks.

IE-313B

Strip insulation and pull bundle. Repair or replace channel nozzles. Also repair or replace the 2" and 8" outlet on the bottom of the reboiler shell. All have suffered severe metal loss from external corrosion.

PROCESS AND UTILITY PIPING

GENERAL

Only a random spot check of the piping could be made during this period of inspection. The random spot check however found slight to severe external corrosion to insulated lines with some lines at failure. Pipe failures were found at various elevation through out the unit. The insulation must be stripped from all process and utility lines in order to determine the condition of each insulated line.

BOILER

GENERAL

The steam drum was found in serviceable condition on the inside. A section of the metal insulation jacket was removed along with insulation in the middle section of this drum. No appreciable external corrosion was noted, but recommend that the rest of the jacket and insulation be stripped to check the rest of the OD for corrosion.

The exterior water wall tubes on the east and west sides have severe metal loss from external corrosion where rain water got behind insulation. The west water wall tubes near the burner have had numerous weld and window repairs. Due to the condition of the tubes in this boiler we recommend that the boiler be retubed.

The two small mud drums for this boiler were dirty and their overall condition could not be determine. Corrosion found to the numerous plugs in these mud drum. New plugs may be required if the seating surfaces can not be repaired.

The economizer tubes are severely corroded and need to be replaced.

The casing of the breeching section above the economizer tubes has failed and needs to be renewed.

The boiler need a complete skin replacement.

The stack was not inspected at this time.

The condition of the soot blowers could not be determine during this inspection.

The air duct are dirty but appear to be in serviceable condition.

External corrosion was found to most lines. Some are corroded to failure. All insulated must be stripped to determine their condition.

The deareator is in poor condition from external corrosion. Metal loss up to .08" was found. Minimum thickness is .13". Corrosion allowance and required thickness is not known. The trays are in serviceable condition. WFMT was not done in this vessel, it should be checked for inservice cracking.

The deareator storage tank is in poor condition from external corrosion. The bottom of drum has suffered severe metal loss. Minimum thickness on west end is .14". Required thickness is not known. The 2" LG nozzle on the bottom west end of tank is holed through. A spot examination for cracking was made to weld seams in the storage tank. No cracks were reported by NDT Service, Inc. who performed the examinations.